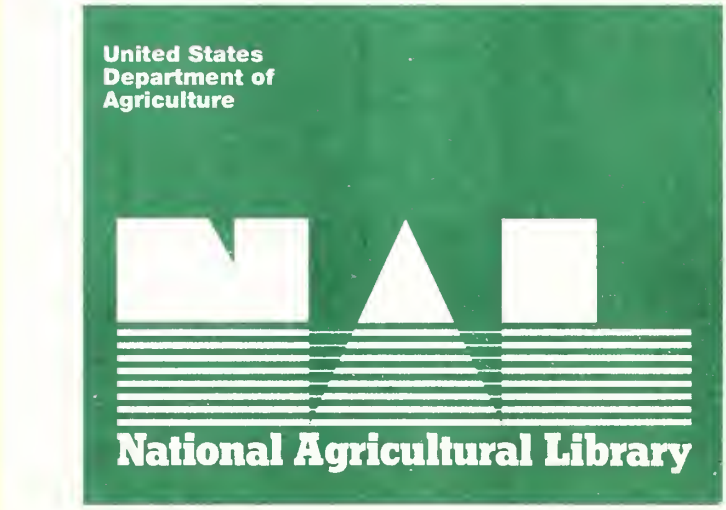
United States
Department of
Agriculture

Economic
Research
Service

**Agriculture and
Rural
Economics
Division**

The Affordability of Urban and Rural Rental Housing

Donald L. Lerman


United States
Department of
Agriculture
National Agricultural Library

THE AFFORDABILITY OF URBAN AND RURAL RENTAL HOUSING. By Donald L. Lerman, Agriculture and Rural Economics Division, Economic Research Service, U.S. Department of Agriculture. Washington, D.C. 20005-4788. December 1985. ERS Staff Report No. AGES850515.

ABSTRACT

This report compares rent-to-income ratios for metropolitan and nonmetropolitan rental households, controlling for income and other demographic characteristics. At the mean income level of approximately $12,000 for the sample, metro households pay approximately 4.5 percent more of their income on rent than do nonmetro renters of similar demographic characteristics. This differential falls to 3.3 percent after one adjusts for differences in urban/rural purchasing power, and it falls to 1.9 percent after one also controls for the quantity of housing consumed. This 1.9-percent rent-to-income differential results solely from differences in the price of housing in metro versus nonmetro areas.

Keywords: Affordability, rural housing, rental housing, housing prices.

ACKNOWLEDGMENTS

I thank William J. Reeder, Carol Meeks, Jim Mikesell, Richard Reeder, Greg Schoepfle, and Tom Hady for their helpful comments.

CONTENTS

The Affordability of Urban and Rural Rental Housing

Donald L. Lerman

INTRODUCTION

The traditional measuring rod of the extent of an area's housing problem is the physical inadequacy of the housing stock. By this measure, housing in rural areas has historically fared far worse than in urban areas. The proportion of substandard occupied housing units in rural areas was more than double that of urban areas from 1950 to 1980. The Federal Government has responded with special housing programs for rural areas. The Farmers Home Administration is the major source of housing assistance for low-income rural households and in fiscal year 1983 allocated over $3 billion in loans and grants for rural housing. Also, 20-25 percent of the funds appropriated for housing programs of the Department of Housing and Urban Development (HUD) must by law go to nonmetropolitan (nonmetro) areas.[1]

In the past decade, housing affordability, or high housing cost in relation to income, has replaced physical inadequacy as the primary concern of housing policy analysts. This study asks whether Federal housing programs for rural areas, which in the past have been justified by the physical inadequacy criterion, are further supported on affordability grounds. From 1950 to 1980, the severity of the Nation's housing problem by the physical inadequacy measure fell dramatically. The proportion of substandard housing fell from 59 percent to less than 6 percent for nonmetro areas and from 22 percent to less than 2 percent for metro areas. During this period, however, U.S. housing costs rose faster on average than income levels. To many, this trend means increased difficulty in affording decent housing for the average American family. Birch and others (1)[2] argue that affordability problems increased substantially as a share of the Nation's housing troubles during the sixties, while the share made up by physical inadequacy problems declined. As the quality of the housing stock continued to improve during the seventies, affordability difficulties continued to grow. For homeowners, housing costs as a percentage of income

---

[1] While the Federal commitment to rural housing assistance is sizable, Federal per capita housing outlays were approximately 36 percent higher in metro areas than in nonmetro areas.

[2] Underscored numbers in parentheses refer to items listed in the references section.

rose from approximately 22 percent in 1970 to more than 35 percent in 1980, with much of the increase occurring since 1977 (2). For renter households, the median rent-to-income ratio rose from 20 percent in 1970 to 27 percent in 1980 (13).

This shift from concern about problems of physical inadequacy to concern about affordability is not surprising since housing costs are bound to rise as physically inadequate units are rehabilitated or replaced by higher quality units. Viewed in this way, affordability problems may be regrettable byproducts of an otherwise encouraging trend of an improving American housing stock. Nonetheless, the burden on a family of an extremely high housing expense-to-income ratio is a real one. This study examines whether this burden is greater for rural or urban households.

In policy discussions, many different meanings are used for the notion of affordability. Hence, we first define affordability and discuss some conceptual problems associated with its measurement. We use consumer demand theory to derive an equation relating a measure of housing affordability to several independent variables. We then discuss the effects of each independent variable upon the dependent variable and present the data sources and empirical findings.

DEFINITION AND GENERAL DISCUSSION OF AFFORDABILITY

A household that spends over 30 percent of its income on housing is often said to have a housing affordability problem.[3] This figure is based on the assumption that for most households the proportion of income needed for food, clothing, taxes, transportation, and so on remains relatively stable over time (8). Thus a household, especially a low-income one, which exceeds the 30-percent housing expense-to-income ratio (or some other guideline ratio)[4] may have difficulty squeezing its nonhousing necessities into its budget.

The goal of reducing problems of housing affordability is implicit in many Federal housing programs. For example, participants in the Section 8 Existing Housing program pay at most 30 percent of their income on rent, thus avoiding a housing affordability problem. Other Federal housing subsidy programs (for example, interest rate reduction subsidies of Section 235 of the National Housing Act) reduce housing affordability problems by directly reducing many households' housing costs, thus reducing some households' housing cost-to-income ratios to below the 30-percent mark.

---

[3] The guideline established by national low-income housing legislation of 25 percent in 1969 was increased to 30 percent in 1981. Other percentage limits (anywhere from 10 to 30 percent) have also been used in differing contexts.

[4] Recently, Stone (9) proposed that the definition of housing affordability be based on household income and size of household. This report takes this idea a step further in considering the role of these and other characteristics of the household in affecting a household's housing expense-to-income ratio.

This study improves upon the above all-or-nothing notion of the housing affordability problem to account for differences in the size of the burden of housing purchase on a household's budget. We adopt the ratio of housing expenditure to income as a continuous measure of affordability, where a higher ratio indicates a greater affordability problem.

This report considers rental households only. Owners are left out because of the difficulty in accurately measuring their housing costs with available data on housing outlays, a problem discussed by Swan (12). However, rental payments plus utilities is a good measure of housing costs for renters.

Since only renters are included, the rent-to-income ratio (where rent includes an estimate of monthly utility costs) is the measure of affordability used in this report.[5] We derive a specification for rent-to-income, the dependent variable in this study and discuss the expected effects of various independent variables upon the rent-to-income ratio.

DETERMINANTS OF AFFORDABILITY

In a standard utility maximization model, the household's demand for housing is given by:

$$q_h = f(y, p_h, p_x, Z) \tag{1}$$

where q_h is quantity of housing demanded, y is income, p_h and p_x are the prices of housing and the nonhousing good, respectively, Z is a vector of exogenous variables including taste factors, and f is an unspecified demand function. Since rent (denoted by r) is given by $r = p_h q_h$, rent-to-income is expressed as:

$$\frac{r}{y} = \frac{p_h}{y} f(y, p_h, p_x, Z) = k(y, p_h, p_x, Z) \tag{2}$$

To determine a functional form for the function k, we first fix prices and exogenous variables at $(\bar{p}_h, \bar{p}_x, \bar{Z})$ and derive a relationship between income and rent-to-income. Assume rent is given by a quadratic function of income:

$$r = a_0 + a_1 y + a_2 y^2 \tag{3}$$

where it is expected that (1) $a_0 > 0$, since rent is expected to be positive even at zero current income; (2) $a_1 > 0$, since housing is a normal good; and (3) $a_2 < 0$, since housing is a necessary (rather than luxury) good.

---

[5] The rent-to-income ratio is often termed "rent burden" by housing program analysts (see (11), pp. 145-149, 169-174). However, this term is not used here since a high rent-to-income ratio is not necessarily a "burden" or an indicator of hardship but may simply reflect an above-average taste for housing, especially when referring to moderate to upper income households.

The rent-to-income ratio is thus given by:

$$\frac{r}{y} = a_0 \frac{1}{y} + a_1 + a_2 y \qquad (4)$$

We assume prices remain fixed and Z enters linearly into the rent-to-income function k in equation (2). Therefore the following specification for rent-to-income is adopted for this study:

$$\frac{r}{y} = a_1 + a_0 \frac{1}{y} + a_2 y + bZ \qquad (5)$$

The remainder of this section discusses the role of each independent variable in equation (5). The effect of income on rent-to-income for alternative assumptions on the income elasticity of demand for housing is presented, followed by sources of potential bias in the measurement of this effect. Next, the rationale and expected effect of all remaining independent variables are presented.

Income

The change in rent-to-income with respect to changes in income may be shown to be a function of the income elasticity of demand for housing (η):

$$\frac{\partial (r/y)}{\partial y} = \frac{r}{y^2} (\eta - 1) \qquad (6)$$

Thus, the rent-to-income versus income contour is downward-sloping, flat, or upward-sloping depending upon whether housing demand is income inelastic, of unit elasticity, or elastic. (Here rent-to-income is placed on the vertical axis and income on the horizontal axis.) (See (11), pp. 169-173, for a discussion of how income elasticity affects housing consumption and rent-to-income as a subsidy increases.) Since most empirical studies have found that demand is income inelastic in the relevant range of incomes (see (7), pp. 96-103), we would expect that the estimate of a_2, which represents the approximate slope of the rent-to-income versus income contour[6] derived from equation (5), would be negative.

There are several sources of potential bias in the relationship between income and rent-to-income. First, the effect of income on rent-to-income will tend to be biased upwards in samples containing households located in several housing markets ("intercity samples"). To see this, first note that cities with higher incomes tend to have higher housing prices. If housing demand is price inelastic, then the higher prices in cities with higher incomes will cause housing expenditures (and thus rent-to-income ratios) to rise. The positive effect of housing prices on rent-to-income

---

[6] To see this, we take the partial derivatives of both sides of equation (5) with respect to y and get:

$$\frac{\partial (r/y)}{\partial y} = a_2 - \frac{a_0}{y^2} \simeq a_2$$

for the range of y considered.

is attributed to income; thus, the effect of income on rent-to-income is upward biased. This effect produces upward bias in the estimate of a_2 and downward bias in a_0.

Second, in samples containing households within a single market ("intracity samples"), the effect of income on rent-to-income will be downward biased. Again the bias occurs because income is correlated with an excluded variable, the price of housing. In this case the correlation is negative since higher income households tend to live further from the city center where housing prices are lower. With price inelastic demand, lower housing prices lead to lower housing expenditures and thus to lower rent-to-income ratios. This effect is attributed to income and causes the effect of income to be downward biased.

Third, bias results from using current income rather than permanent income. We assume that housing consumption is primarily affected by permanent income and that the marginal propensity to consume housing out of transitory income is nearly zero. Since high-income households generally have a positive transitory income component, their rent-to-income ratio will be less than if all of their current income were permanent. Similarly, lower income households, who will tend to have a negative transitory income, will have greater rent-to-income than expected. Thus, the use of current rather than permanent income imparts a negative bias to the effect of income on rent-to-income.

Fourth, downward bias may result from the use of a renters-only sample since tenure choice is related to income. As household income increases, the proportion of renters to total households begins to drop off as more and more households choose to become homeowners. Many of these new homeowners have increased their housing expenditures beyond the level of those households of identical income who have chosen to remain renters. However, since only the latter group shows up in our sample, the estimated coefficient of the income term is biased downward.

It is not clear what the net bias produced by the above sources will be.

Urban/Rural Location

Urban areas are characterized by higher land prices than rural areas. Does it follow then that rent-to-income ratios will tend to be higher in urban than in rural areas, if one controls for differences in income and other demographic variables? Not necessarily, because higher land prices do not necessarily imply higher rents. To see this, we follow Kain and Quigley (5) and view housing services as a heterogeneous good made up of dwelling unit quality, interior space, neighborhood quality, and exterior space. In this formulation, rent equals the product of the vector of quantities of housing characteristics and a hedonic price vector. It is expected that the higher the price of land, the higher the hedonic price of the exterior space characteristic; thus, the hedonic price is expected to be greater in urban than in rural areas. Even if the hedonic prices of all other housing characteristics were identical for urban and rural areas, rent may be higher in rural areas if, for example, the demand for the characteristic exterior space were price elastic, assuming identical tastes among rural and urban households. Higher rents in rural areas could also

result if the demand for each characteristic were price inelastic and if the hedonic prices of all characteristics not affected by land prices were greater in rural areas. If one were willing to assume that the higher urban price of land drove each hedonic price for urban areas above that for rural areas and that the demand for every characteristic was price inelastic, one could assure rent would be higher in urban than in rural areas. (Other strong assumptions could also generate this result.) However, without evidence that these assumptions hold, it is not clear in theory that urban rents should on average exceed rural rents. Since the direction of the effect of rural location on rent is ambiguous when income is held constant, the direction of the effect of rural location upon the rent-to-income ratio is also unclear.

Age of Householder

The life-cycle hypothesis suggests that individuals spread out consumption during their lifetimes in a pattern much smoother than those of their income streams, which typically peak in the middle years and drop in the early and late years of life. This trend will tend to produce a rent-to-income ratio which is high in the early years, falls to a minimum during the peak years of employment, and rises later in life. Thus, age and age squared are included as independent variables, where we expect the effect of age to be negative and age squared to be positive.

The relative income hypothesis suggests that the effect of age on rent-to-income is downward biased. It argues that an elderly household will feel richer or have greater "relative income" than a nonelderly household of the same current income level since the average income of elderly households is lower than it is for nonelderly households. If the elasticity of demand for rental housing out of relative income is less than one, the elderly household will have a lower rent-to-income ratio than the nonelderly household of the same current income but lower relative income level. This effect on the rent-to-income ratio of the elderly household will be attributed to age and will thus cause a downward bias in the coefficient measuring the effect of age on rent-to-income. To correct for this bias, we include a variable measuring relative income as an explanatory variable.[7]

Another factor, the use of pretax income as the measure of current income, may result in downward bias in the estimate of the effect of the age variable. This bias occurs because, as is well known, the aged pay less in taxes than the nonaged at given levels of income. Therefore if housing demand is inelastic with respect to disposable income, an elderly household will have a lower rent-to-income ratio than a nonelderly household of the same pretax income.

Sex of Householder

Some female household heads may have been recently divorced or abandoned by a husband. Thus, they may have recently experienced a reduction in

---

[7] Households were arbitrarily divided into eight age groups. A household's relative income (RY) was defined as current income divided by mean income for the age group to which the household belonged.

household income, but have not yet moved to a cheaper apartment. This phenomenon will occur for a smaller proportion of male-headed households, since these households will include as a base the bulk of married-couple households. Thus, the rent-to-income ratio will tend to be higher on average for households with a female householder than with a male householder.

Race of Householder

Theoretical and empirical results of the housing discrimination literature suggest several reasons why the ratio of rent to income for black householders is either higher or lower than for white householders. Models of seller prejudice suggest blacks pay higher prices for similar housing bundles than whites do. Yinger ((16), pp. 450-452) has found, for example, that blacks pay an average 15 percent more than whites for comparable housing within any given neighborhood. This finding is consistent with higher rent-to-income ratios for black households. Others argue that seller discrimination takes the form of restrictions on the quantity of housing supplied to blacks. Strasheim (10) has found that black households consume smaller amounts of housing than do white households of similar income and life-cycle characteristics. If Strasheim's controlling for life-cycle characteristics restricts black and white households of equal income to identical demand curves, then rent-to-income ratios for black households will be higher (lower) than for white households if the demand for housing is price inelastic (elastic).

On the other hand, models of prejudice by white buyers suggest that whites will pay a premium to live in housing which is all-white or has a low percentage of blacks. Studies by King and Mieszkowski (6) and Yinger (15) and others have found that while whites tend to pay higher housing prices the lower the percentage of blacks in a neighborhood, prices for blacks may fall as the percentage of blacks increases. This finding would lead to higher rent-to-income ratios for white households.

Finally, differences in rent-to-income ratios may result from differences in the taste for housing between black and white households.

Number of Persons in Household

Household demand for space increases with household size. Hence, larger households tend to occupy larger dwellings, and their rent-to-income ratios thus tend to be higher.

Regional Location

Regions of the country vary in average housing cost and in average income level. This variation may produce differences in average rent-to-income ratio for a given income level. If the cost variation between two regions is uniform (that is, if housing costs and income are greater in one region

than in another by the same proportion), the higher cost region will tend to have a higher rent-to-income ratio for a given nominal income level. The reason is that households base their consumption decisions on real (rather than nominal) income, and any given nominal income level represents a lower real income level for the high-cost region. Given income inelastic demand for housing, the rent-to-income ratio is thus higher in the high-cost region. Given this result and the Consumer Price Index (CPI) figures by region shown below, we might expect the rent-to-income ratios to be highest in the North Central region, followed by the South, the West, and the Northeast.

CPI, all items, all urban consumers, 1979

	Ratio
Northeast	114.7
North Central	118.2
South	117.4
West	117.3

There are two problems with this conclusion. First, if the cost variation between two regions is not uniform, it is not clear whether the high-cost or low-cost region will have uniformly higher rent-to-income ratios for given income levels. Second, the above CPI figures are for urban consumers only. If rural areas have significantly different cost and income levels than do urban areas, then the comparison of cost levels by region is biased since the regions vary widely in percentage rural (for example, the percentage of nonmetro households in the South is 41, but only 16 in the Northeast). For these reasons, there is no particular expectation for the signs of the coefficients of the regional dummy variables used in this study. Rather, the regional dummies are included to control for any differences between regions in housing costs, income levels, other prices, or other factors influencing rental housing markets.

Recent Mover

It is well known that households which have moved within the last year will tend to pay higher rents than households which have occupied otherwise identical dwellings for more than a year because of the loss of length of tenure discounts. These discounts would tend to be especially large in areas with rent control. Thus, recent mover households are expected to have higher rent-to-income ratios than households which have been at their location for more than a year.

Urban/Rural Income Interaction

The urban/rural income interaction variable, defined as the product of income and a dummy variable which identifies the location as nonmetro or metro, is included to allow for the possibility that the rent-to-income versus income contour may be differently sloped in rural areas compared with urban areas. Any such difference will reflect differences in income

elasticities between rural and urban areas and thus may imply a difference in the effectiveness of demand-side housing programs in rural and urban areas (see (4) for an alternative treatment of this issue).[8]

THE DATA AND EMPIRICAL FINDINGS

The data used in this study are from the 1979 Annual Housing Survey, a nationwide survey of over 60,000 households, conducted by the Census Bureau for the Department of Housing and Urban Development. This analysis is restricted to renter households which pay positive cash rent and which earn positive income. Units in which the occupying households receive a Government rent subsidy or are enrolled in a public housing project were not included. Vacant units and units in which the usual residence is elsewhere were also deleted. After these restrictions, the sample consisted of 15,481 households. Approximately three-fourths of the sample (11,314 households) were located in metro areas, and the remainder (4,167) were nonmetro households.

This section first examines the actual data on the rent-to-income ratios of nonmetro and metro households of similar income levels in this sample. Next, it presents the first of three regression results and compares the fitted rent-to-income values of nonmetro households with those of metro households, controlling for income and all other independent variables already discussed. This same exercise is then performed controlling for metro/nonmetro differentials in costs of living (second regression) and controlling for the quantity of housing consumed as well as differential metro/nonmetro costs of living (third regression). Finally, the effects of all remaining demographic variables on the dependent variable are discussed.

Evidence on Actual Rent-to-Income Ratios

Table 1 presents a cross-tabulation of actual rent-to-income ratios of all households in the sample by income group and metro/nonmetro status. This table illustrates that nonmetro renter households spend a smaller percentage of their income on rent on average than do metro households of the same income group. The gap between metro and nonmetro rent-to-income ratios falls with income, ranging from 10.4 percent for the income range of 0-$5,000 to 1.8 percent for incomes of $25,000 and greater.

Regression Results: Basic Findings

The basic form of the estimating equation used in this study is equation (5) above (where a random error term is added to the right hand side). Thus, the dependent variable rent-to-income is regressed on a constant,

---

[8] In a separate regression run, other urban/rural interaction variables were added to the specification, allowing for the possibility that the impact of the variables sex, race, age, and region may be significantly different in rural and urban areas. The results showed that, while the total effect of rural location was unchanged, the separate effect of these variables in rural areas captured nearly the entire effect of rural location.

Table 1--Actual average rent-to-income ratios

Income (dollars)	Metro Households	Nonmetro Households	Gap
		Ratio	
0-4,999	68.4	58.0	10.4
5,000-9,999	37.5	30.6	6.9
10,000-14,999	25.5	20.2	5.3
15,000-19,999	19.2	16.0	3.2
20,000-24,999	16.3	12.9	3.4
25,000 +	12.8	11.0	1.8

income, the reciprocal of income, and all remaining independent variables already discussed. Table 2 lists the estimated coefficients for the three regressions and lists the definition of each variable below the regression results.

In regression 1, the estimated effects of two variables, the metro/nonmetro dummy NONMET and the metro/nonmetro income interaction variable NMINC, suggest that nonmetro renter households spend a significantly smaller percentage of their income on rent than do metro renter households of similar income and other characteristics. For example, at an income of $2,000, rent-to-income for nonmetro households will be approximately 3.8 percentage points lower than for demographically identical metro households.[9] This difference rises to 7.3 percentage points at the $24,000 income level. At any given income level, however, metro households will tend to differ from nonmetro households in characteristics other than simply their metro/nonmetro location. For example, average household size is slightly larger for nonmetro households (2.53 persons) than for metro households (2.29 persons), which contributes to a difference in rent-to-income of metro versus nonmetro households. Thus, we calculate the fitted values of rent-to-income for metro and for nonmetro households by plugging in specific income levels and by evaluating all other variables at their mean levels within the respective metro and nonmetro subsamples.

Table 3 displays these fitted values of rent-to-income for metro households (RI_m), nonmetro households (RI_{nm}), and the difference ($RI_m - RI_{nm}$) at various income levels from $2,000 to $24,000. These figures and the fitted value equations (table 3) suggest the following:

(1) Metro rent-to-income ratios exceed nonmetro ratios by amounts ranging from 2.8 percentage points at income of $2,000 to 6.4 percentage points at income of $24,000. The gap between metro and nonmetro rent-to-income ratios increases with income because the

[9] The effect of the variables NONMET and NMINC on the rent-to-income of a nonmetro household of income $1,000 is given by -3.77, the sum of NONMET (-3.45) and NMINC times income (-0.00016)(2000) = -0.32. For metro households, this effect equals zero.

Table 2--Regression results

Regression dependent variable	1 RI	2 RI	3 HRI
		Coefficient estimates	
NONMET	-3.45*	-3.31*	-1.41*
INC	-.0008*		
RINC		-.0008*	-.0009*
NMINC	-.00016*		
NMRINC		.00001	.000003
RY	-9.92*		
RRY		-9.28*	-15.8*
INCRECIP	186.35*		
RINCRECIP		183.87*	158.21*
SEX	6.55*	6.56*	3.44*
RACE	-1.28*	-1.28*	1.93*
PER	1.06*	1.06*	.11
REGNC	-2.25*	-2.25*	-3.37*
REGS	-4.40*	-4.41*	-4.93*
REGNE	.01	-.002	1.30*
RM	5.86*	5.86*	3.42*
AGE	-.60*	-.54*	-.73*
AGESQ	.007*	.007*	.009*
Constant	58.11	56.91	71.25*
R^2	.46	.46	.62

* = passed 2-tailed t test at 0.01 level.

Variable	Definition
AGE	Age of householder in years
AGESQ	AGE*AGE
HRI	Hedonic rent-to-income
INC	Household income in dollars
INCRECIP	1/(INC)
NMINC	NONMET*INC
NMRINC	NONMET*RINC
NONMET	1 if in nonmetro area, 0 if in metro area
PER	Number of persons in household
RACE	1 if householder is black, 0 otherwise
REGNC	1 if in North Central region, 0 otherwise
REGNE	1 if Northeast region, 0 otherwise
REGS	1 if South region, 0 otherwise
RI	Rent-to-income ratio times 100
RINC	Real household income
RINCRECIP	1/(RINC)
RM	1 if lived in current location for less than a year, 0 otherwise
RY	Relative income
RRY	Real relative income
SEX	1 if householder is female, 0 otherwise

Table 3--Fitted values for regression 1

Income (dollars)	RI_m	RI_{nm}	$RI_m - RI_{nm}$
		Ratio	
2,000	39.06	36.23	2.83
4,000	37.51	34.36	3.15
6,000	36.00	32.52	3.48
8,000	34.50	30.69	3.81
10,000	32.99	28.86	4.13
12,000	31.49	27.03	4.46
14,000	29.99	25.21	4.78
16,000	28.49	23.38	5.11
18,000	26.99	21.56	5.43
20,000	25.50	19.74	5.76
22,000	24.00	17.91	6.09
24,000	22.50	16.09	6.41

Fitted value equations:

$RI_m = 40.46 + 186.3/INC - .000749*INC$

$RI_{nm} = 37.96 + 186.3/INC - .000912*INC$

sign for the coefficient of NMINC is negative, which causes the slope of the nonmetro rent-to-income versus income contour to be steeper (more negative) than the metro contour. One interpretation of this finding is that the downward bias in the income variable which is due to the effect of tenure choice is stronger in nonmetro areas, since homeownership is more prevalent in nonmetro than in metro areas.

(2) Rent-to-income falls with income for both metro and nonmetro rental households. This finding suggests that the demand for housing for both metro and nonmetro rental households is income inelastic over the income range considered.

Results after Controlling for Metro/Nonmetro Cost of Living Differences

Bureau of Labor Statistics (BLS) data for 1979 show that a constant-quantity bundle representing total monthly budget expenses for an intermediate standard of living for a family of four costs approximately 12 percent more in metro areas than in nonmetro areas (14, table 2). Stated differently, a dollar of income in nonmetro areas will buy approximately 12 percent more than in metro areas. Thus, it is appropriate to compare rent-to-income ratios of metro and nonmetro households whose incomes reflect the same purchasing power, not just those whose incomes have the same nominal value.

Therefore, "real income", RINC, is defined as:

$$RINC = \begin{cases} INC & \text{in metro areas} \\ 1.122*INC & \text{in nonmetro areas} \end{cases}$$

where INC represents nominal income. In regression 2, all income variables on the right hand side of regression 1 (INC, NMINC, RY, and INCRECIP) are replaced with their real income counterparts (RINC, NMRINC, RRY, and RINCRECIP).

Regression 2 estimates (table 2) are virtually unchanged from the respective regression 1 estimates, with one exception. The metro/nonmetro income interaction variable changes from significantly negative (estimate of NMINC in regression 1) to not significantly different from zero (estimate of NMRINC in regression 2). That is, there is virtually no difference between the slopes of the metro and nonmetro rent-to-income versus income contours. Thus, the estimate of NONMET in regression 2, -3.3, tells us that rent-to-income for nonmetro households is approximately 3.3 percentage points less than for metro households throughout the income range.

The fitted values of rent-to-income based on regression 2 estimates (table 4) are consistant with this conclusion. The fourth column of table 4 shows that the difference between metro and nonmetro rent-to-income fitted values is nearly constant, ranging from 3.4 at income of $2,000 to 3.2 at income of $24,000. Two additional conclusions follow from these figures:

1. Although the gap in rent-to-income at $24,000 income (3.2 percentage points) is slightly smaller than at $2,000 income (3.4 percentage points), the percentage by which metro rent exceeds nonmetro rent is greater at $24,000 (where metro rent is 17 percent higher) than at $2,000 (where metro rent is 9 percent higher). As suggested in regression 1, this difference may reflect the greater presence of homeownership in rural areas than in urban areas, which may lead the downward bias in the income variable from the effect of tenure choice to be stronger in rural areas.

2. As in regression 1, rent-to-income falls with income for both metro and nonmetro households, indicating income-inelastic demand for housing over the income range.

Results after Controlling for Quantity of Housing

Some of the variation in the dependent variable rent-to-income is due to differences in the quantity of housing services purchased. If, for example, metro renters consume more or higher quality housing than nonmetro renters at a given income level, the measured difference ($RI_m - RI_{nm}$) in fitted rent-to-income ratios will tend to be greater than the difference in rent-to-income if all respondents were constrained to purchase an identical

Table 4--Fitted values for regression 2

Income (dollars)	RI_m	RI_{nm}	$RI_m - RI_{nm}$
		Ratio	
2,000	39.77	36.33	3.44
4,000	38.12	34.71	3.42
6,000	36.51	33.11	3.40
8,000	34.90	31.53	3.37
10,000	33.30	29.95	3.35
12,000	31.70	28.37	3.33
14,000	30.10	26.80	3.31
16,000	28.50	25.22	3.28
18,000	26.90	23.64	3.26
20,000	25.30	22.07	3.24
22,000	23.71	20.49	3.22
24,000	22.11	18.91	3.19

Fitted value equations:

$RI_m = 41.27 + 183.9/INC - .000799*INC$

$RI_{nm} = 37.81 + 183.9/INC - .000788*INC$

housing bundle. In regression 3, a hedonic technique is used to control for the quantity of housing in the measurement of the dependent variable, while still controlling for metro/nonmetro cost of living differences. The estimates of regression 3 should tell us the difference between metro and nonmetro rent-to-income which results solely from differences in housing prices and not from quantities.

The hedonic rent for each household was computed, assuming all households consume an identical housing unit.[10] This unit rents for an amount given by a hedonic rent equation, mapping the characteristics of this housing unit plus certain household characteristics thought to independently affect rent into a hedonic rent figure.[11] Dividing hedonic rent by household income gives us hedonic rent-to-income (abbreviated HRI).

---

[10] This housing unit is comprised of a fixed bundle of housing characteristics, each set equal to the national average for all rental units observed in the 1979 Annual Housing Survey.

[11] Eight hedonic rent equations were estimated and used to compute hedonic rent--one for the metro and nonmetro portions of each of the four Census regions. A list of these eight equations and the housing unit characteristics included in these equations is available on request from the author. The set of housing characteristics used is similar to the set used by Follain and Malpezzi (3).

In regression 3, hedonic rent-to-income is the dependent variable regressed against the set of independent variables used in regression 2. The results of regression 3 (table 2) show that the hedonic rent-to-income of nonmetro households is approximately 1.4 percentage points less than that for metro households of equal income and other characteristics.[12] Although this difference is statistically significant, it is less than half the average regression 2 metro/nonmetro difference in rent-to-income of approximately 3.3 percentage points.

Table 5 shows the fitted values of the dependent variable for regression 3. We discover:

1. The size of the metro/nonmetro gap in fitted hedonic rent-to-income is approximately 1.9 percentage points throughout the income range from $2,000 to $24,000. Comparing the hedonic rent-to-income gap from column 4 of table 5 with the rent-to-income income gap from column 4 of table 4 at each income level, we find that 56 to 58 percent of the 3.2 to 3.4 percentage point rent-to-income gap is apparently due to differences in the price of housing in metro and nonmetro areas. The remaining 42 to 44 percent of the rent-to-income gap may be attributed to metro-nonmetro differences in quantity (or quality) of housing consumed.

2. The hedonic rent-to-income versus income contours are steeper (have a more negative slope) than the rent-to-income versus income contours for both metro and nonmetro households as both the fitted values and fitted value equations of tables 4 and 5 illustrate. To see why this makes sense, note first that controlling for the quantity of housing in the calculation of hedonic rent-to-income is tantamount to assuming zero income elasticity of demand for housing, since households of all income levels are assumed to consume an identical quantity of housing. Plugging in a zero for income elasticity in equation (6), we find that the slope of the hedonic rent-to-income versus income contour is smaller (more negative) than the slope of the rent-to-income versus income contour, which is calculated assuming positive income elasticity.

Effects of Demographic Variables

Table 2 includes the effects of the following demographic variables on rent-to-income and hedonic rent-to-income.

Age of Householder

As expected, age is significant and negatively related to rent-to-income, whereas age squared is significant and positive for each of the three regression specifications. This situation leads to a U-shaped rent-to-income versus age profile, which is consistent with the life-cycle and relative income hypotheses we have presented. In figure 1, the fitted

[12] This difference of 1.4 percentage points is nearly constant throughout the income range, since the coefficient of NMINC in regression 3 is not significantly different from zero.

Table 5--Fitted values for regression 3

Income (dollars)	HRI_m	HRI_{nm}	$HRI_m - HRI_{nm}$
		Ratio	
2,000	40.64	38.71	1.93
4,000	38.77	36.84	1.92
6,000	36.92	35.00	1.92
8,000	35.08	33.17	1.91
10,000	33.25	31.34	1.91
12,000	31.41	29.51	1.90
14,000	29.58	27.69	1.89
16,000	27.75	25.86	1.89
18,000	25.91	24.03	1.88
20,000	24.08	22.20	1.88
22,000	22.25	20.38	1.87
24,000	20.41	18.55	1.86

Fitted value equations:

$RI_m = 42.39 + 158.2/INC - .000916*INC$

$RI_{nm} = 40.46 + 158.2/INC - .000913*INC$

values of the dependent variables of regressions 2 and 3 are plotted for ages ranging from 20 to 70, where all other independent variables have been evaluated at their respective means for the entire (metro and nonmetro) sample.

Figure 1 shows that both curves fall with age in the younger years (up to age 42 for the regression 2 curve and age 39 for the regression 3 curve) and rise with age in the older years. During the younger years, hedonic rent-to-income (regression 3 curve) closely tracks rent-to-income (regression 2 curve). However, beyond age 45, hedonic rent-to-income rises faster than rent-to-income. Thus, the rise in rent-to-income from its minimum of 30 percent at age 42 to approximately 35 percent at age 70 actually understates (by about 4 percentage points) the rise in rent-to-income which would occur if all households were constrained to consume an equal quantity of housing.

Sex of Householder

The coefficients of SEX (table 2) for regressions 1 and 2 suggest that rent-to-income is 6.6 percentage points higher for female-headed households than for male-headed households of similar income and other characteristics. This finding is consistent with our earlier expectation. In regression 3, the coefficient of SEX falls to 3.4. This finding suggests that of the 6.6 percentage point gap between female and male

Figure 1

Rent-to-Income by Age

rent-to-income ratios, 3.2 percentage points may be attributed to differences in the quantity or quality of housing purchased and the remaining 3.4 points are due to differences in housing prices.

Race of Householder

Regressions 1 and 2 suggest that black renter households pay a slightly smaller proportion of their income (approximately 1.3 percentage points less) on housing than do white households of similar income and other characteristics. However, when we control for quantity of housing, this finding is reversed: blacks pay 1.9 percentage points higher in rent-to-income for similar housing bundles than whites do. Black housing consumption appears to be sufficiently less than white consumption so that black rent-to-income ratios are slightly lower than for whites.

The seller discrimination model may explain the finding of higher housing prices for blacks than for whites. Either price elastic demand for housing[13] or a stronger taste for housing by whites than by blacks[14] could result in the finding of lower black rent-to-income ratios.

Number of Persons

The number of persons in a household has a significant positive effect upon rent-to-income. For example, a three-person household will tend to have a rent-to-income ratio approximately 1.1 percent higher than a two-person household, as seen by the coefficients of PER in regressions 1 and 2 of table 2. In regression 3, however, the effect of household size becomes insignificant. This finding is not surprising since the reason we expect larger households to have higher rent-to-income ratios is that they tend to occupy a larger units. Since the quantity of housing is held fixed in regression 3, this effect is removed.

Regional Location

According to regressions 1 and 2, rent-to-income ranks highest on average in the Northeast and West regions, followed by the North Central and South regions. Compared with a household in the Northeast or the West, the rent-to-income of a demographically similar household in the North Central region would be 2.3 percentage points lower and in the South would be 4.4 points lower. The results are similar for regression 3, except that the Northeast ranks significantly higher (by 1.3 percentage points) in rent-to-income compared with the West. This finding suggests that ceteris paribus, housing prices are slightly higher in the Northeast than in the West, but that the quantity of housing consumed is slightly higher in the West, resulting in nearly equal fitted values for rent-to-income in regressions 1 and 2.

---

[13] Most empirical evidence suggests that housing demand is price inelastic. In this case, seller discrimination would imply higher rent-to-income ratios for black households (see (7), pp. 103-104).

[14] The margin of the taste difference must be large enough to lower black rent-to-income ratios below the white level and not so large as to result in lower housing prices for blacks.

Recent Mover Households

The coefficients of RM in the regressions 1 and 2 of table 2 indicate that households residing at their current dwelling for less than a year pay nearly 6 percentage points more of their income on rent than do households at their current residence for a year or more. This finding is consistent with the theoretical expectation on the effect of recent mover status on rent-to-income. The effect of RM of 3.4 in regression 3 suggests that more than half of this effect may be labeled a "tenure discount." That is, the effect of landlords charging lower rent to long-term tenants results in lower rent-to-income by an average of 3.4 percentage points.

Urban/Rural Income Interaction

The effect of the urban/rural income interaction variable NMINC in regression 1 is significant and negative, which imples that the income elasticity of demand for housing is smaller in rural areas. Thus, the effect of a cash grant of a given dollar amount on housing consumption would be larger in metro areas than in nonmetro areas. To estimate how much larger the metro effect would be under present housing programs, we ran a simulation using regression 1 estimates of the effect of a $150 monthly cash grant (about the value of the average-sized Section 8 Existing Housing subsidy in 1979) on housing consumption. We found the increase in rent resulting from the cash grant 36.8 percent in metro areas and 35.0 percent in nonmetro areas, a difference of less than 2 percent.[15] Furthermore, the effect of the urban/rural income interaction variable NMRINC in regressions 2 and 3 is insignificant. This finding suggests that there is no difference in the increase in housing consumption in metro versus nonmetro areas resulting from a cash grant adjusted to have the same purchasing power in metro and nonmetro areas.[16]

CONCLUSIONS

The basic findings of this study follow.

First, rent-to-income ratios fall with income throughout the income range for both metro and nonmetro households, indicating income inelastic demand for housing at all income levels.

---

[15] The difference between the rent increase in metro and nonmetro areas widens to 4.5 percent if the size of the grant is increased to $300 per month, or double the value of the average Section 8 Existing Housing subsidy in 1979 (the percentage rent increase figures are 70.5 in metro areas and 66.0 in nonmetro areas). Since a doubling of the size of present housing programs seems unlikely, this finding has less policy importance than the finding in the text of less than 2-percent difference in rent increase between metro and nonmetro areas.

[16] The effects of a Section 8-type subsidy will in general differ from the effects of an equivalent cash grant since the Section 8 subsidy will include a price effect and will require housing consumption to fall between a minimum and maximum level.

Second, nonmetro renter households pay approximately 4.5 percent less of their income on rent than do metro households of similar characteristics, when evaluated at mean income ($12,397) for the sample. This gap between average metro and nonmetro rent-to-income ratios ranges from 3.2 percentage points at $4,000 income to 6.4 percentage points at the $24,000 income level.

Third, after adjusting all income variables for differences in the purchasing power of a dollar in urban versus rural areas, we find as before that rent-to-income declines with income and is smaller in nonmetro areas than in metro areas throughout the income range. However, at the mean income level for the sample, the gap between metro and nonmetro rent-to-income narrows slightly from the above 4.5-percent figure to 3.3 percent. This metro/nonmetro gap is nearly constant over the income range considered.

Fourth, after controlling for the quantity of housing, we are left with a metro/nonmetro gap of 1.9 percentage points throughout the income range. Thus, of the average 3.3-percentage-point rent-to-income gap obtained before controlling for quantity, 42 percent is due to differences in housing quantity. The remaining 58 percent of this gap results from differences in the price of housing in metro and nonmetro areas.

REFERENCES

(1) Birch, David, and others. America's Housing Needs. Cambridge, MA: Joint Center for Urban Studies of MIT and Harvard, 1973.

(2) Buckley, Robert A., and Robert A. Van Order. "Housing and the Economy: Popular Myths," American Real Estate and Urban Economics Association Journal, 11 (Winter 1983): 421-441.

(3) Follain, James R., and Stephen Malpezzi. "Dissecting Housing Value and Rent: Estimates of Hedonic Indexes for Thirty-Nine Large SMSAs." Working Paper 249-17. Washington, D.C.: The Urban Institute, 1979.

(4) Ihlanfeldt, Keith R. "Income Elasticities of Demand for Rental Housing: Additional Evidence," Urban Studies, 19 (1982): 65-69.

(5) Kain, John F., and John M. Quigley. Housing Markets and Racial Discrimination. New York, NY: National Bureau of Economic Research, 1975.

(6) King, Thomas A., and Peter Mieszkowski. "Racial Discrimination, Segregation, and the Price of Housing," Journal of Political Economy, 81 (1973): 590-606.

(7) Mayo, Stephen K. "Theory and Estimation of Housing Demand," Journal of Urban Economics, 10 (1981): 96-103.

(8) Meeks, Carol. Housing. Englewood Cliffs, NJ: Prentice-Hall, Inc., 1980.

(9) Stone, Michael E. "Housing and the Economic Crisis: An Analysis and Emergency Program," in America's Housing Crisis. (ed. Chester Hartman). Boston, MA: The Institute for Policy Studies, 1983.

(10) Straszheim, Mahlon. An Econometric Model of the Urban Housing Market. New York: National Bureau of Economic Research, 1975.

(11) Struyk, Raymond J., and Marc Bendick, Jr. (ed.). Housing Vouchers for the Poor. Washington, D.C.: The Urban Institute, 1981.

(12) Swan, Craig. "The Affordability of Unaffordable Housing." Unpublished paper, 1978.

(13) U.S. Bureau of the Census, U.S. Department of Commerce. Annual Housing Survey, 1980. Part A. Series H-150-80. 1982.

(14) U.S. Department of Labor. Bureau of Labor Statistics. "Autumn 1979 Urban Family Budgets and Comparative Indexes for Selected Urban Areas." Washington, D.C., 1980.

(15) Yinger, John. "The Black-White Differential in Housing: Some Further Evidence," Land Economics, 54 (1978): 187-206.

(16) _____. "Prejudice and Discrimination in the Urban Housing Market," in Current Issues in Urban Economics (ed. Peter Mieszkowski and Mahlon Straszheim). Baltimore, MD: The Johns Hopkins University Press, 1979.

*U.S. GOVERNMENT PRINTING OFFICE: 1985-490-917:20245-ER